ACHIEVING AND MAINTAINING GOOD PRESS LUBRICATION

Proper lubrication is essential to the proper functioning and freedom from downtime of any stamping press. A basic requirement for proper safe operation is to follow the manufacturer’s instructions concerning all aspects of maintenance including lubrication.

Press Lubrication Basics

The type of lubrication system varies with the type, size and operating speed of the press. Small OBI and OBS presses often have a manual lubrication system. If grease is used, applying with a manual grease gun on scheduled basis is essential.

It is important not to over lubricate the machine. A checklist to insure all items are serviced as needed is helpful. An important part of machine lubrication is manually wiping up lubricant seepage with rags or cotton waste. Keeping the machine clean makes leakage problems easy to find.

Larger machines usually employ recirculating lubrication systems. Filtering the returned lubricant and pumping it to the points lubricated recycles the lubricant. Such systems are standard for most new presses and retrofitted to older machines not having this feature.

Lost Oil and Grease Systems

Presses that do not recycle the lubricant are termed lost lubricant systems. An advantage is lower initial cost of the press. Both oil and grease are used.

Grease has important advantages for some presses especially older machines having open gearing and relatively large bearing clearances. The advantages include:

1. Grease tends to stay where applied.

2. Grease can withstand shock loads.

3. Generally less frequent application is needed than that required for oil.

4. More than one type of lubricant can be applied—a factor which permits optimization for each application.

Major Disadvantages of Lost Oil and Grease Systems
If lubricants were free and created no mess, lost oil and grease systems would be ideal for nearly any application. However, in the world of reality this is impossible. Major disadvantages of lost oil and grease systems include:

1. Essentially all lubrication results are a one-time use of the lubricant.
2. Labor to clean up the residue of waste oil and grease that accumulates on and around the press.
3. The lost lubricants may require disposal as hazardous waste.
4. Housekeeping problems and potential fire hazards may result.

Cost of Cleaning and Waste Lubricant Disposal
Any lost lubricants are cleaned up with mops, and or oil absorbents. In some cases, press lubricant may contaminate the parts produced. Increasingly, waste lubricants constitute hazardous waste.

The cost of proper disposal by a licensed waste disposal contractor increasingly exceeds the cost new lubricant. Further, the liability for correct disposal of hazardous wastes primarily rests with the company that created the waste.

These factors provide a powerful incentive to reuse lubricants by recirculating systems and reprocessing contaminated or spent lubricants. Lubricant suppliers are increasingly providing turnkey programs to manage all lubricants and chemicals used at a stamping facility. Such arrangements can be very cost effective. Advantages include:

1. Rapid accessibility to lubricant and chemical engineering assistance
2. Expert control of hazardous materials and employee right to know requirements.
3. Both on and off site recycling of spent lubricants.
4. Recordkeeping requirement accomplishment.
5. Allows the metal stamper to concentrate on their core business of metalforming.

Applying the Proper Amount of Lubricant
The best economy of machine life and over-all lubricant cost requires the correct type and amount of lubricant applied as needed. Over lubrication is wasteful and can actually harm the machine.

Metering of Lubricant
Both lost grease and lost oil lubrication systems may make use of intermittently actuated pumps that apply lubricant from a central point. A simple system may make use of a hand pump operated as needed. Automatic systems meter the lubricant by press-driven mechanical actuating devices, or a signal from a timer or stroke counter.

**Lubricant Distribution Systems**
Both metered and recirculating lubricant systems usually require one or more lubricant distribution points. Each distribution point has a series of small pistons contained in a valve block. Pressurized lubricant applied to the valve block inlet results in each piston displacing a fixed amount of lubricant metered to a series of outlets.

![Diagram](image)

**Figure 1.** A centralized lubrication system having features that warns of lubrication problems. *Lubriquip, Inc., A unit of IDEX Corporation* ²

Typically, the system shoots lubricant to each bearing in a fixed sequence. A blocked line can stall the entire system. To avoid this failure in manually pumped systems, the last outlet connects to a return line that actuates a signal that the lubrication sequence is completed. Automatic systems often use either electrical limit or inductive proximity switches at the lubrication distribution devices to remotely signal distribution piston positions.

Figure 1 illustrates a centralized lubrication system having pins that indicate that each piston has shifted to deliver lubricant to the respective outlet. Another illustrated feature are broken line indicators used to signal a loss of lubrication to critical points. These detectors are very useful to safeguard critical bearings that are not easily visually inspected. During normal operation, lube pressure is in the line at all times. A check valve in the broken line indicator and a special pressure relief valve called a simulator at the bearing do this. Loss of pressure actuates an extendable pin on the indicator, which may actuate a sensor to signal a loss of lubrication.

Over lubrication can result in excessive pressures, which may damage seals. Excessive lubricant can contaminate parts as well as seep into electrical control systems. Consideration of the potential for a fire hazard, especially if welding operations are nearby.

Recirculating Lubricant Systems
Larger presses generally have recirculating lubrication systems. This is also the case with many smaller presses intended for high-speed and heavily utilized applications. The three most important benefits of a recirculating lubricant system are:

1. The system continuously filters and recycles the lubricant.
2. The oil flow cools bearing surfaces.
3. Flushing of particulate matter from critical bearing surfaces.

Figure 2 illustrates a high tonnage geared press having a recirculating cascade lubrication system. The oil reservoir is located in the press bed. The oil is pumped from the reservoir, filtered and distributed to all points needing constant lubrication.

The solid lines in the illustration distribute the lubricant under pressure. The reservoirs return lines are identified with dashes.

Lubricant Reservoirs
Usually the reservoir is contained in the bed of the press as illustrated in figure 2. Some very large presses requiring pits may have the reservoir, filtration and pumping system that is a self-contained unit. This is illustrated in Figure 3. It is important that the reservoir design avoids the entry of contaminants and easy to clean when the lubricant is periodically changed.

Lubricant Pumps
Motor-driven press lubricant pumps are usually of the positive-displacement gear or rotary vane type. A wire-mesh strainer is on the inlet to keep out foreign objects that could damage the pump. Typical sizes range from one quarter (0.186 KW) to five (3.73 KW) or more horsepower, depending on the requirements of the press.
Figure 2. Diagram of a cascade-type recirculating lubrication system installed on a high-tonnage geared press. *Verson Corporation*
Filter and Pressure Relief Valve
The pressurized lubricant is filtered. The filter is usually a replaceable cartridge type that is easily changed. A relief valve maintains the correct pressure. Excess lubricant returns to the reservoir.

Lubricant Lines
Steel tubing or pipe is an excellent material for lubricant distribution lines. Copper tubing is not as strong as steel and subject to work-harden from vibration. If copper tubing is used, it should be hard temper material intended for machine lubricant line applications. Route the lines away from areas that would expose them to damage.

Plastic lubrication lines used on small presses and multi-slide forming machines are economical for some applications. Synthetic fiber reinforced plastic lubricant lines have proven to be an acceptable choice in some applications on larger presses.

Supplying Lubricant to Moving Bearings
Lubricant lines to pitman bearings and other moving parts must withstand flexure. Flexible hydraulic hose is a good choice. The use of lightweight plastic lines for this application invites failure.

The press designer must take into consideration the pressure developed in the oil film within the moving bearing. This hydrodynamic lubrication pressure can easily exceed the lubricant supply pressure at bearing journal areas with high loads. Therefore, to avoid bearing failure, the flexible supply line is to the low hydrodynamic lubrication pressure area of the bearing.

Dual lines
The lubricant supplied to reciprocating bearings tends to be thrown out, and must be continually be replenished. Rapid failure can occur should they run dry. Two lubricant lines supply critical bearings from separate distribution device ports. This dual line supply method provides additional lubricant, and is a good way to provide redundancy in case one line should fail.

Lubricant Return
Figure 2 illustrates lubricant return lines with dashes. All oil returns or “cascades” to the reservoir by gravity flow. Contaminants such as metal-forming lubricants, solvents, welding debris and grinding grit must not mix with the lubricating oil.

All of the oil supplied to the gears and bearings in the crown drains down the inside of the columns or uprights. The oil from the pitman and connection bearings drains into the slide. A pipe connects to the side of the slide returns oil to the inside of a column. The return oil from the gibbs drains into a small trough under each gib. These troughs each have screens to keep debris from stopping up the return lines, or entering the reservoir.

Scheduling Filter and Lubricant Changes
The frequency of filter maintenance may be determined in several ways. The press manufacturer’s specify lubrication recommendations on days of elapsed time or hours of operation since the last filter change. Several filter changes may occur before a complete lubricant change.

Some filter housings have a gauge that indicates the pressure differential across the filter. As the filter accumulates dirt, the difference in pressure between the inlet and outlet increases. The amount of pressure difference indicates on the gauge with the dial calibrated in units of pressure and color-coded. For example, green may indicate a safe pressure difference, yellow an intermediate condition and red an excessive pressure drop.

Most press manufacturers recommend a specific grade of medium to high viscosity mineral oil for recirculating systems. Although some oil may break down due to attack by oxidation, most of the oil remains reclaimable for reuse. Lubricant changes are required because of contamination and loss of the effectiveness of additives. While scheduled intervals are required, the lubricant changed whenever contaminants such as metal forming lubricants accidentally enter the system is a necessity.

**Lubricant Requirements for Recirculating Systems**

Recirculating systems employ the same lubricant to perform tasks ranging from lubricating gearing where extreme pressures occur, to supplying pressure to hydraulic overload system. Flat sliding bearings such as gibbing and cushion liners as well as counterbalance packing may use the same lube.

The choice of lubricant is necessarily a compromise in order to meet all requirements. Extreme pressure, anti-oxidant and anti-foaming additives are often used to improve the lubricant properties for such multiple applications.

**Thermostatically Controlled Oil Heater Systems**

Some presses have oil reservoirs with thermostatically controlled electrical heaters. Heated oil is easier to pump and distribute throughout the system. Temperature control of the recirculating lubricant serves to aid in maintaining the press at a constant temperature.

Supplying lubricant at a constant temperature lessens the amount of component expansion caused by frictional heat buildup. This is an important means of reducing process variability, especially in precision high-speed applications.

**Additional Advantages of Heating the Recirculating Oil**

Warm oil is less apt to contaminate with water from condensation. Another advantage is that entrapped air releases more rapidly. To aid in the release of entrapped air, it is helpful to provide an angled perforated metal screen for the returned oil flow. Placing the screen at approximately a 30° angle will expose the returned lubricant to a large area to aid in the release of entrapped air and evaporation of any moisture.
Lubricant Reservoir with Filter Housings and Pump

Figure 3. A large lubricant reservoir, pump and filters for a Danly 1000 ton 204 inch press. The reservoir is a freestanding unit located in the press pit.

Inspecting and Troubleshooting Lubrication Systems

The proper functioning of the press lubrication system is essential if long machine life is expected. A thorough check is an important part of the formal inspection procedure. In addition, a visual check should be part of the routine inspection performed several times a day. Manually applied lube procedures can occur at this time if needed.

Routine Visual Inspection
A trained press operator or diesetter one easily does visual Inspection of the gibs for proper lubrication or more times each shift. If the pitmans and other critical bearings are visible from the floor level, be sure that are wet with lube, indicating proper flow. Check the reservoir level and pressure gauge readings for any change.
Oil Leaks
Investigate the source of any oil leak reported by the operator at once. While some oil seepage is normal, a pronounced drip or flow often indicates serious problems. If lubricant sprays from the crown or slide, a broken line check occurs immediately.

Another common, and easy to remedy source of leaks, is blockage of a return line. For example, a rag or glove carelessly left in the slide or crown will stop-up an oil return pipe.

A report of an oil leak is critical information, not a labor complaint. Erecting a pasteboard or plastic tent to shield the operator is a foolish reaction, not a solution. The root cause of the problem requires correction. Failure to repair oil leaks wastes lubricant, and creates a combined fire hazard and housekeeping problem. If a broken line is the cause, an expensive press failure is very likely.

Oil Foaming and Air Entrapment
Foaming of the lube oil can result from several causes. These include:

1. Contamination by cleaning solutions and metal forming lubricants.
2. An air leak on the suction side of the recirculating pump.
3. A lack of anti-foaming additives where needed.
4. Failing to warm the oil as an aid to release water and air.

Foaming of lube oil can result in poor lubrication. For example, should any foaming or air entrapment occur in the lubricant, it would enter the hydraulic overload system and cause spongy action. This difficulty can result in severe product variation problems that are difficult to pinpoint.

Lube Inspection and Chemical Analysis
Providing a sample valve at the outlet of the recirculating pump is a simple way to draw lube samples. Visual inspection for cloudiness, contamination, particulate matter and air entrapment in a clear glass container, is a part of the periodic inspection procedure. Chemical analysis, including a spectrographic test for small amounts of bearing materials such as copper, tin, and chromium can reveal wear materials that cannot be seen in visual examinations. The results of these periodic tests pinpoint press problems and determine the optimum frequency of lubricant changes.

When draining filters and lube reservoirs, clean out all sediment and check for metallic particles and debris. Metallic particles such as bronze and cast iron indicate a specific type of machine wear is occurring. Welding slag and welding rod stubs indicate careless maintenance practices. Food and smoking material remains suggests a need to instill better housekeeping practices.
Lubricant Reservoir with Clean out Access Cover

Figure 4. Note the clean out access hole cover and thermometer in this large reservoir. The oil outlet to the recirculating pump is to the right of the dial thermometer.

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